

**Marine Area 9
Mark-Selective Recreational Chinook Fishery,
January 16 – April 15, 2008**

Post-season Report

REVISED DRAFT

February 20, 2009

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EXECUTIVE SUMMARY

The Washington Department of Fish and Wildlife (WDFW) implemented a winter (season: January 16–April 15, 2008) mark-selective Chinook fishery (MSF) in Marine Area 9 for the first time. Consistent with the 2004 Puget Sound Chinook Harvest Management Plan (Puget Sound Indian Tribes and WDFW 2004) and the intent of previous Puget Sound/Strait of Juan de Fuca mark-selective Chinook fisheries, the primary goal for this pilot fishery was to provide meaningful opportunity to the recreational angling public while minimally impacting ESA-listed Puget Sound Chinook salmon. WDFW’s Puget Sound Sampling Unit (PSSU) implemented an intensive monitoring program in Area 9 throughout February in order to collect the data needed to estimate key parameters characterizing the fishery and its impacts on unmarked salmon. Sampling activities included inclusive of dockside creel sampling, test fishing, and on-the-water effort surveys. Among other parameters, efforts emphasized data collection needs for the estimation of: *i*) the mark rate of the targeted Chinook population, *ii*) the total number of Chinook salmon harvested (by size [legal or sublegal] and mark-status [marked or unmarked] group), *iii*) the total number of Chinook salmon released (by size and mark-status group), *iv*) the coded-wire tag- (CWT) and/or DNA-based stock composition of marked and unmarked Chinook mortalities¹, and *v*) the total mortality of marked and unmarked double index tag (DIT) CWT stocks.

Creel samplers staffed two of four different access sites on 64 of the 91 days that Area 9 was open under mark-selective harvest regulations. Samplers interviewed an estimated 15% of all participating anglers ($n = 1,007$ angler trips) and sampled 17% of all marked Chinook harvested ($n = 227$). Additionally, other PSSU staff conducted eight on-the-water effort surveys, and spent 51 days (240 hours) on the water pursuing Chinook using test fishing methods, in support of Area 9 monitoring efforts. Based on these activities, we estimated that 6,887 angler trips were completed by a combination of private fleet, charter, and derby anglers between mid-January and mid-April. With a CPUE of 0.20 Chinook landed per angler trip for all angler groups combined, these anglers harvested a grand total of 1,409 marked Chinook; they released an estimated 2,162 Chinook (1,484 marked, 679 unmarked). Harvested Chinook averaged 66 cm (range: 53 to 92 cm) in total length and were larger than the legal minimum size limit (≥ 22 in or 56 cm TL) in most instances (dockside marked Chinook observations, 215 legal /227 total or 95%). Over half (55%) of all harvested individuals were 3-year olds (brood year 2005), with brood year 2004 making up the 45% remainder. In addition, 24 CWTs were recovered from harvested fish, the majority of which (91.7%) were from Puget Sound (83.3%, predominantly from north Puget Sound facilities) and Hood Canal (8.3%) release sites.

During their three months of sampling in Area 9, test fishers encountered 94 Chinook salmon, 51% and 81% of which were of legal size and marked, respectively. With a “CPUE” of 0.92 (i.e., LM Chinook encounters / angler trip), test fishers encountered legal-marked Chinook at a higher rate than did at-large private fleet anglers but at a rate comparable to that experienced by charter anglers. Chinook encountered by test fishers averaged 57 cm in total length and

¹ Though the necessary tissue samples have been collected, DNA-based estimates of stock composition are presently unavailable for Puget Sound/Strait of Juan de Fuca mark-selective fisheries. In the present report, CWT-based (unexpanded) estimates of the stock composition of marked Chinook harvest are provided.

were predominantly 3 years in age (89% of marked and 81% of unmarked totals). For the fishery as a whole, we estimated the size/mark-status composition at 42.6% legal-marked, 8.5% legal-unmarked, 38.3% sublegal-marked, and 10.6% sublegal-unmarked.

By combining dockside sampling results (i.e., legal-marked Chinook harvest estimates), test fishery size/mark-status composition data, and charter census results, we generated size/mark-status group-specific estimates of encounters and mortalities. In total, 3,570 Chinook were encountered (retained and released) during the Area 9 fishery, with 1,528 of these being legal-marked, 307 legal-unmarked, 1,360 sublegal-marked, and 375 sublegal-unmarked individuals. Among released encounters, an estimated 29 legal-marked, 46 legal-unmarked, 258 sublegal-marked, and 75 sublegal-unmarked Chinook (408 overall) were estimated to have died due to handling and release effects. Thus, in total, 1,816 marked (83% due to direct harvest) and 124 unmarked Chinook mortalities occurred as a result of the Area 9 fishery. Although estimated legal-marked Chinook impacts were within ~20% of what pre-season Fishery Regulation Assessment Model runs predicted (model run 3907), field estimates for the three other size/mark-status (i.e., for sublegal-marked fish and unmarked fish of all sizes) groups were considerably less (50-74%) than what was expected. Finally, regarding impacts of MSFs on the coded-wire tag (CWT) program, we estimated that 7 unmarked Chinook belonging to double-index tag (DIT) groups may have died due to the handling-and-release impacts of the pilot Area 9 fishery.

INTRODUCTION

In recent years, abundant runs of hatchery Chinook salmon (*Oncorhynchus tshawytscha*) have been mixed with depressed runs of wild Chinook salmon in the marine environments of the Puget Sound and Strait of Juan de Fuca. Providing recreational anglers with opportunities to harvest abundant hatchery stocks while simultaneously protecting weaker, wild stocks has proven to be a significant conservation and management challenge. The combination of large-scale hatchery marking (i.e., fin clipping) programs and mark-selective harvest regulations makes it possible for anglers to pursue and harvest hatchery Chinook salmon while minimally impacting wild salmon populations. In such “mark-selective fisheries” (MSFs), anglers are generally allowed to retain adipose-fin clipped (“marked”) hatchery fish and are required to release unharmed any unclipped (“unmarked”, predominantly wild) salmon encountered².

Since the first marine selective Chinook fishery occurred in Marine Catch Areas 5 and 6 (Strait of Juan de Fuca) in 2003 (WDFW 2008a), mark-selective Chinook salmon fishing regulations have been implemented on a pilot basis in multiple Puget Sound Marine Catch Areas during both summer and winter seasons. As of the close of the 2006-07 fishing season, pilot *summer* selective Chinook seasons have occurred in Areas 5 and 6 for five years (2003-2007; WDFW 2008a) and in Areas 9, 10, 11, and 13 for one year (2007; WDFW 2007a and 2007b); pilot *winter* selective Chinook fisheries have occurred in Areas 8-1 and 8-2 for two complete seasons (2005-06 and 2006-07; WDFW 2008b). From January 16 to April 15, 2008, the Washington Department of Fish and Wildlife (WDFW) implemented a winter mark-selective Chinook fishery in Area 9 for the first time. Consistent with the 2004 Puget Sound Chinook Harvest Management Plan (Puget Sound Indian Tribes and WDFW 2004) and the intent of previous mark selective Chinook fisheries, the primary goal for this pilot fishery was to provide meaningful opportunity to the recreational angling public while minimally impacting ESA-listed Puget Sound Chinook salmon.

Given the pilot nature of the Area 9 selective Chinook fishery, WDFW’s Puget Sound Sampling Unit was tasked with implementing an intensive monitoring program during the entirety of its January 16 through April 15 season. Our primary goal was to collect the data needed to estimate key parameters characterizing the impacts of this fishery on wild salmon. As per State–Tribal agreement (WDFW and NWIFC 2007), we tailored our sampling so that we could reliably estimate: *i*) the mark rate of the targeted Chinook population, *ii*) the total number of Chinook salmon harvested (by size [legal or sublegal] and mark-status [marked or unmarked] group), *iii*) the total number of Chinook salmon released (by size and mark-status group), *iv*) the coded-wire tag- (CWT) and/or DNA-based stock composition of marked and unmarked Chinook mortalities³, and *v*) the total mortality of marked and unmarked double index tag (DIT) CWT stocks. In addition, we acquired and analyzed relevant data characterizing other aspects of the

²The regulations specific to the 2008 Area 9 mark-selective fishery allowed for the retention of up to two legal-sized (≥ 22 inches [56 cm]) marked Chinook salmon per day and required the immediate release of all unmarked or sublegal Chinook. Additionally, anglers were: *i*) required to use single-point, barbless hooks while fishing for salmon, *ii*) held to a combined (all salmon species) two-fish daily limit during the Area 9 mark-selective fishery, and *iii*) held to a handling rule that prevented them from bringing unmarked and/or sublegal Chinook aboard their vessels.

³ Though the necessary tissue samples have been collected, DNA-based estimates of stock composition are presently unavailable for Puget Sound/Strait of Juan de Fuca mark-selective fisheries. In the present report, CWT-based (unexpanded) estimates of the stock composition of marked Chinook harvest are provided.

pilot fishery, including descriptors of fishing effort, fishing success (catch [landed Chinook] per unit effort), the length and age composition of encountered Chinook, and the overall intensity of our sampling efforts.

In the following pages, we report the results generated through our Area 9 monitoring activities. We first provide a brief review our in-season sampling and post-season assessment methods and then present detailed results for each component of our selective-fishery monitoring program. Results are presented according to the following sequence: *i*) the intensity (i.e., spatial and temporal coverage) of sampling efforts is described; *ii*) estimates of fishery characteristics obtained from creel survey data are reviewed; *iii*) the results from our recreational test fishery are presented; and *iv*) total fishery impacts—estimated based on the combination of creel and test fishery data—are reviewed and compared with pre-season expectations (i.e., based on Fishery Regulation Assessment Model [FRAM] predictions). Finally, we provide a detailed description of our impact estimation scheme as well as additional and relevant data in a series of appendices (i.e., sample-rate tables and sampling summaries; age composition tables [for landed catch and test fishery encounters]; and raw CWT recoveries).

METHODS

Marine Catch Area Description

Marine Area 9 is a relatively large area encompassing over 200 square miles (512 km²) of marine water in central Puget Sound. Area 9 starts at the mouth of Admiralty Inlet (i.e., its northern boundary is at the Partridge Point–Point Wilson line) and extends southward to the Apple Cove Point–Edwards Point line, including the marine waters extending south from Foulweather Bluff to the Hood Canal Bridge (**Figure 1**). As is the case for other winter salmon fisheries that occur in Puget Sound, immature Chinook salmon (“blackmouth”) are the predominant fish targeted and encountered by anglers fishing in Area 9 between January and April.

Monitoring Program Overview

Our sampling program for the Area 9 fishery incorporated comprehensive and complementary data collection strategies, including dockside angler interviews (with catch sampling), on-the-water (instantaneous) effort surveys, test-fishery-based sampling, and voluntary reports of completed trips provided by charter boats and private anglers (**Figure 2**). Although we provide a brief review the field and analytical methods associated with our sampling efforts here, we refer the reader to WDFW (2007b or 2008b) for additional detail.

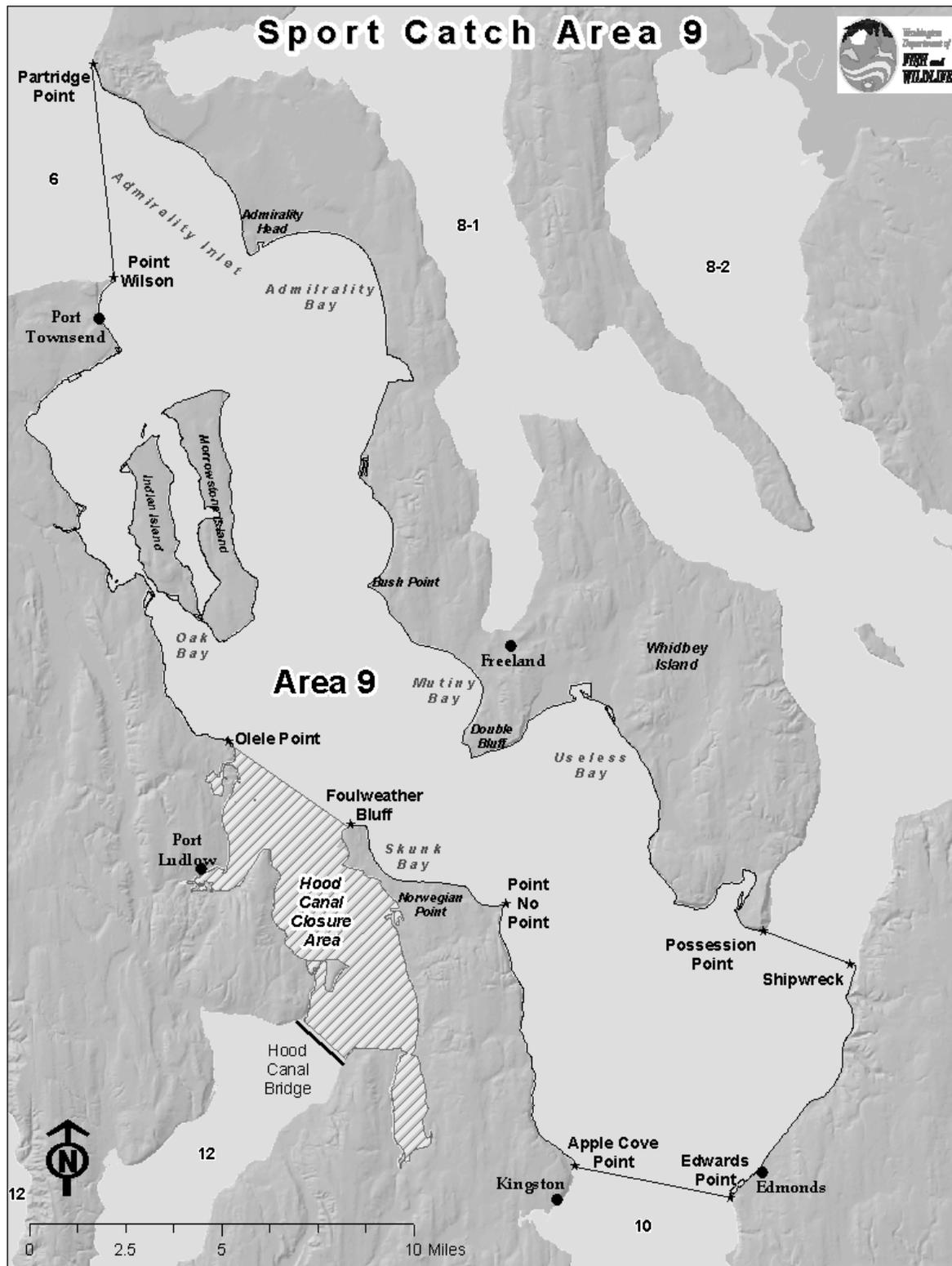


Figure 1. Map of Marine Catch Area 9 in Puget Sound, where the first season of the pilot winter selective Chinook fishery occurred from January 16 through April 15, 2008. The Hood Canal Closure Area was open for Chinook retention for the duration of this fishery.

Catch and Effort: Sampling and Estimation

We collected data on total catch (observed harvest and reported releases⁴) and total angling effort using a two-stage stratified cluster sample design. At the first stage, we selected five sample days from two temporal strata (weekday [Monday-Thursday], with $n = 2$ days sampled; weekend [Friday-Sunday], with $n = 3$ days sampled) during each week of the fishery. On each selected sample day, we selected two access points (i.e., public ramps, boathouses, etc.) from our Area 9 sample frame for creel sampling. Access site (i.e., cluster) selection was achieved at the second stage using a probability-proportional-to-size (PPS) sampling algorithm (the Yates-Grundy or “natural” method, Cochran 1977). The measure of size used in PPS sampling was equivalent to the fraction of total sample-frame effort attributed to a given site; this quantity was estimated using data collected during instantaneous on-the-water surveys (i.e., “boat surveys”) conducted routinely during the course of the fishery. Our sample frame included all moderate-to-high effort, public boat launch facilities that are used to access Area 9, including: Everett Ramp (10th St), Pt. Townsend Boat Haven Ramp, Ft. Casey/Keystone, and Kingston Public Ramp. Given that some effort was excluded from our sample frame (i.e., private and/or low-effort access sites), we also estimated the out-of-frame effort proportion from boat survey data and accounted for this quantity in estimates of fishery-wide totals (e.g., catch and effort).

At access sites selected for sampling on scheduled sample days, samplers interviewed *all* anglers exiting the Area 9 fishery. During interviews, samplers acquired data on trip duration, trip intent (i.e., targeted species), fishing method(s) employed (downrigger or diver trolling, jigging, mooching, or other), and fish encountered (kept and/or released, by species). When an interviewed party possessed Chinook or coho salmon, samplers inspected them for CWTs using wand detectors, and collected snouts from CWT+ individuals for later lab processing. Additionally, samplers took length measurements (fork and total) and scale samples from landed Chinook.

By combining dockside interview data with estimated size measures, we generated daily estimates (and variances) of total fishing effort and landed Chinook catch (by mark-status group) for our sample frame using Murthy’s population-total estimator (Murthy 1957, Cochran 1977, WDFW 2008b). We then expanded these estimates to account for the out-of-frame effort proportion and then again to obtain stratum-wide totals (**Table 1**). To minimize the influence of recall bias on our assessment, we estimated Chinook releases as the difference between retained catch (i.e., from the Murthy estimator, based on observed landings) and total Chinook encounters (i.e., releases = encounters – retained catch) generated using the bias-corrected Conrad and McHugh (2008) approach. Briefly, encounters were estimated by dividing the creel estimate of legal-marked Chinook harvest by a test fishery-based estimate of the proportion of the fishable Chinook population that is of legal size and marked (i.e., our former “Method 2” approach; e.g., WDFW 2007b). Given that this approach yields negatively biased estimates if anglers release any of the legal-marked Chinook they encounter, Conrad and McHugh estimated a “correction” factor to account for this phenomenon and incorporated it into their estimator

⁴In a recent evaluation of bias in mark-selective fishery parameter estimates, Conrad and McHugh (2008) concluded that recall errors likely cause bias in interview-based estimates of total salmon *releases*. Thus, although estimates of total salmon releases based solely on angler-reported data were generated for this report (**Appendix D**), we focus exclusively on bias-corrected “Method 2” estimates of Chinook encounters (and releases) in our review of the Area 9 fishery.

(See **Appendix A** for complete computational details). Although we do not review estimates of Chinook releases based solely on angler accounts in our assessment, we supply these estimates, as well estimates of retained catch and/or reported releases for other salmon species, in appendices to this report (**Appendix D**).

As a final note, given the higher catch per unit effort (CPUE) of charter anglers relative to that of the private recreational fleet and the difficulty in directly sampling their catch (e.g., due to private moorage), we acquired creel data for these anglers through a separate but comprehensive effort. We contacted known salmon charters operating in Area 9 and coordinated with them so that they would complete and return creel information for all trips taken using supplied Voluntary Trip Report (VTR) forms. Total salmon catch (kept and released) and fishing effort data were assumed to be the result of a complete census and simply added to the survey-based estimates generated for the private fleet. Although they were not used in producing creel estimates, VTRs were also completed and returned by a subset of private fleet anglers.

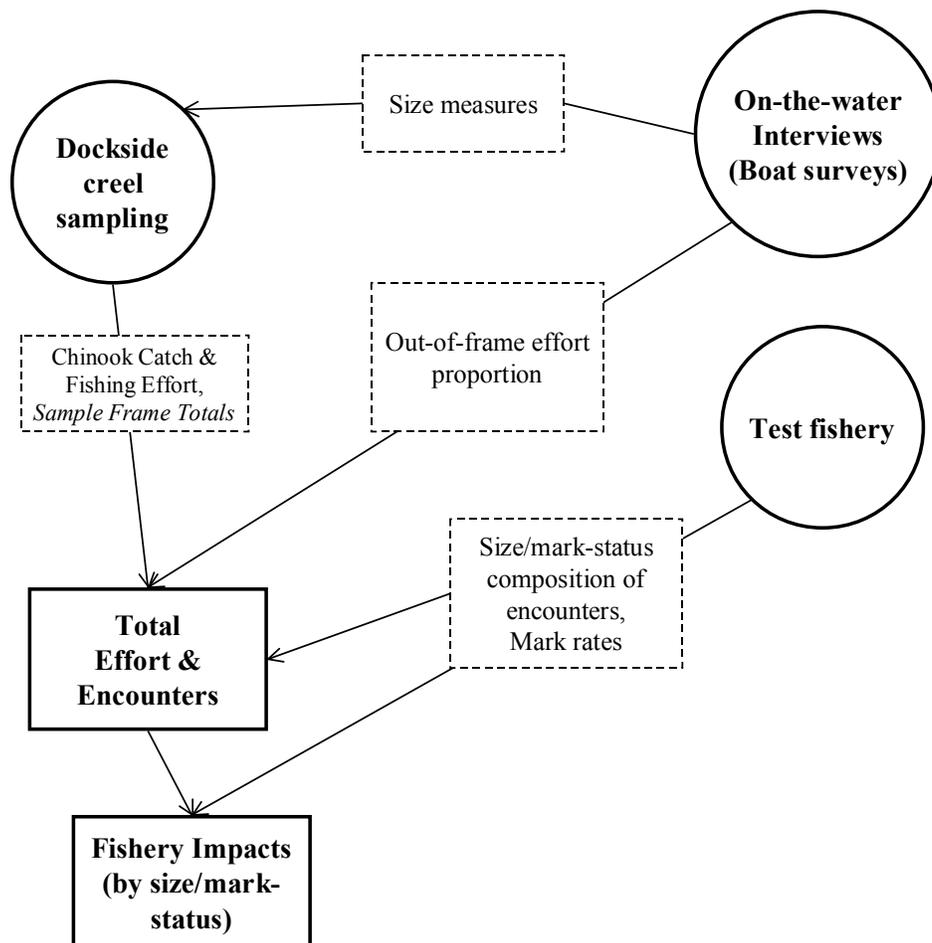


Figure 2. Conceptual diagram of the monitoring plan implemented in Area 9 during its January 16 – April 15, 2008 mark-selective Chinook season. Circles represent discrete sampling activities, dashed boxes represent parameters that are estimated using data from a given activity, and solid boxes depict key quantities estimated from the comprehensive plan. ‘Encounters’ includes both harvested and released Chinook salmon.

Test Fishery Methods

In order to obtain accurate estimates (i.e., free from survey-based recall error) of the size (legal or sublegal) and mark-status (marked or unmarked) composition of the pool of Chinook salmon encountered by anglers participating in the fishery, we conducted a recreational test fishery during the entirety of the mark-selective Chinook season (**Table 1**). Our test boat crew consisted of two WDFW technicians, each fishing with a single rod for five days a week (Monday-Friday). Test fishers focused their efforts at locations that optimized their overall encounter rate and mirrored choices made by the at-large private fleet. Also, test fishers fished for Chinook using the same methods as the recreational fleet, as prescribed by supervisory staff based on dockside interview results for the preceding week. For each fish brought to boat, test fishers logged details on its identity (species), size (fork length and total length), and, if appropriate, mark status (marked or unmarked). For Chinook salmon encounters only, test fishers additionally collected scale and DNA samples (~1-cm² piece of dorsal tissue).

Estimating Fishery Impacts

Total Encounters and Mortalities

We characterized the overall impacts of the fishery in terms of grand-total estimates of encounters and mortalities and by using estimates specific to each of the four size/mark-status groups (i.e., legal-marked [LM], sublegal-marked [SM], legal-unmarked [LU], and sublegal-unmarked [SU]; **Table 1**). As indicated above and in contrast to previous post-season selective fishery reports, we used only one approach to estimate total Chinook encounters and, consequently, mortalities. This single method was selected as a result of a thorough state-tribal review of bias potential in estimators of encounters in MSFs (see Conrad and McHugh 2008 for details). In brief, encounters were estimated by dividing creel estimates of legal-marked Chinook harvest by the test fishery-based proportion of the targeted Chinook population that was of legal size and marked, inclusive of a bias correction accounting for the modest level legal-marked Chinook release that occurs in this fishery. We then decomposed total encounters into size/mark-status group-specific estimates using test-fishery encounters composition data.

We estimated total Chinook mortality resulting from the fishery by applying assumed mortality rates to the total harvest and release estimates for the four size/mark-status groups (LM, LU, SM, and SU). For retained Chinook, the mortality estimate was equivalent to the total harvest estimate for the applicable size/mark-status group. We applied selective fishing mortality (*sfm*) rates of 15% and 20% to legal (marked and unmarked) and sublegal (marked and unmarked) release totals, respectively, to estimate release mortality. See **Appendix A** for a complete description of our impact estimation procedure, including formulae for total and variance estimators.

The final step of our overall impacts assessment involved comparing fishery outcomes to pre-season expectations. To do this, we compared season-total estimates of Chinook encounters and mortalities to pre-season modeled values (FRAM model run number 3907) for each size and mark status category.

Table 1. Sampling/estimation details on target parameters associated with the overall Area 9 mark-selective fishery monitoring program (**Figure 1**).

Activity	Focal Parameter(s)	Secondary Parameter(s)	Sample Unit(s)	Finest Estimation Time Step	Comments
Dockside Creel Sampling	Fishing effort (boat & angler trips); kept and released fish ¹	Catch rates (CPUE); length, age, and CWT composition of harvest ²	Angler trip; kept fish; reported fish release	Week ¹	Within weeks, estimates are also produced by strata (weekday/weekend).
Test Fishing	Size (legal/sublegal) and mark-status composition (marked, unmarked) of encountered Chinook	Chinook length, age, and DNA-based ³ stock composition; species composition of non-Chinook encounters	Fish encounter	Season (3 months)	Too few encounters occurred to assess mark rates on a finer time scale.
Overall Fishery Impacts Estimation	Total Chinook encounters and mortalities, by size/mark-status group	Ratios of encounters and mortalities per kept Chinook	N/A	Season (3 months)	The temporal resolution of impact estimates is constrained by that of the test-fishery encounters data.
Coded-wire tag (CWT) Impacts Estimation	Marked/unmarked double-index tag (DIT) encounters and mortalities	N/A	N/A	Season (3 months)	The temporal resolution of DIT impacts is constrained by the total number of tags recovered.

¹ Under the "bias-corrected Method-2" approach, Chinook releases can be estimated only as finely as test fishery data allow.

² The length and CWT composition of landed catch was assessed on a season-wide basis for impact estimation.

³ Though samples were collected, DNA-based estimates of stock composition are not yet available for this fishery.

CWT Impacts

To understand the potential effects of the Area 9 fishery on the CWT program, we estimated the total number of unmarked-tagged Chinook mortalities that may have occurred during the course of its three-month, January 16-April 15, 2008 season. To do this, we acquired information for all marked CWT double index tag (DIT) groups present in landed catch from the Pacific States Marine Fisheries Commission's Regional Mark Information System (RMIS) and then applied the methods described by the Selective Fisheries Evaluation Committee – Analysis Work Group (SFEC-AWG 2002) to estimate the number of unmarked DIT fish encountered⁵. We subsequently estimated the number of these fish that may have died due to hook-and-release impacts using an *sfm* analogous that used in FRAM modeling. Given our interest in characterizing the impacts of mark-selective regulations on the CWT program and not recreational fishing in general, we used an *sfm* of 10% in all unmarked-DIT mortality calculations. Thus, we used 10% instead of 15% (applied above to legal-sized releases) since unseen drop-off mortality (the 5% differential) is a feature common to selective and non-selective recreational Chinook fisheries.

⁵ For all unmarked-DIT encounters and mortalities calculations, we relied on the unmarked-to-marked abundance ratio (λ) estimated for DIT groups at the time of juvenile release.

RESULTS & DISCUSSION

Summary of Sampling Efforts

Sampled Access Sites

Sites within the Area 9 sample frame included Everett Public Ramp, Edmonds Marina Dry Storage, Fort Casey/Keystone Ramp, Kingston Public Ramp, and Port Townsend Boat Haven Ramp. All of the sites in the sample frame were sampled at least once during the course of the fishery, with the exception of Ft. Casey/Keystone (**Table 2, Appendix E**). At the start of the fishery, sites were selected based on historical catch and effort data and sampling supervisor knowledge. As the fishery progressed, site picks was made exclusively using in-season boat survey data.

Table 2. List of sites sampled during the Area 9 January 16-April 15, 2008 selective Chinook fishery.

Area 9 Sampled Sites	Total Days Sampled	% of Total
Everett Ramp (10th St)	64	50.0%
Edmonds Marina Dry Stack	5	3.9%
Ft. Casey/Keystone	0	0.0%
Kingston Public Ramp	9	7.0%
Pt Townsend Boat Haven Ramp	50	39.1%
TOTAL	128	100.0%

Boat Survey Summary

In Area 9, we conducted a total of 8 boat surveys between January 16th and April 15th, 2008 (**Table 3**). Boat surveys were used to estimate the percentage of total fishing effort originating at sites contained in our sample frame (versus never-sampled sites) and the proportion of angler effort originating at each access site (i.e., their size measure). Data from seven out of the eight boat surveys were used to guide site selection and parameter estimation throughout the fishery. Data from the boat survey conducted on February 16, which was representative of the two-day Discovery Bay Salmon Derby, were used only for catch and effort estimation during the February 16-17 stratum given the influence of this event on the distribution (i.e., access-site origin) and abundance of anglers participating in the fishery. In total, samplers interviewed 205 boats (377 anglers) over the seven non-derby boat surveys; 45.6% of interviews anglers exited the fishery at sites contained in our sample frame. During the Discovery Bay Salmon Derby survey, samplers interviewed 163 parties (362 anglers) and determined that 23.4% of interviewed anglers planned to exit the fishery at one of the two sample sites staffed during the two-day stratum (**Appendix E**).

As a final note, winter fishery characteristics were such that on foul weather days and weekdays, angling effort was minimal or non-existent in Area 9. Thus, we attempted to complete boat

surveys on days when safe boating conditions prevailed and a non-trivial level of angling effort was present. As a result, six different boat surveys had to be rescheduled over the course of the fishery.

Table 3. Monthly summary of angler surveys conducted during the winter 2008 Area 9 selective fishery.

Boat Survey Schedule: Area 9	
Month	Date Conducted
January	1/18, 1/27
February	2/15, 2/16, 2/24
March	3/8, 3/15, 3/16
Total Surveys	8

Fishery Characteristics

Estimates of Fishing Effort and Catch

For private boats fishing in the Area 9 winter selective fishery we estimated that a total of 1,374 Chinook (1,371 marked and 3 unmarked) were retained during 6,837 angler trips (**Table 4**). Anglers released a total of 2,128 Chinook (1,461 marked and 667 unmarked). Thus, the total number of Chinook encountered (retained plus released) by private boats in the Area 9 winter selective fishery was 3,497 (2,832 marked and 670 unmarked). Area 9 anglers did not encounter any other species of salmon.

Charter angler effort in the Area 9 winter selective fishery constituted a minor portion of the overall effort for the fishery (< 1% of all angler trips). Two charter operators reported taking a total of 50 angler trips in Area 9 between January 16 and April 15 (**Table 4**). Charter anglers encountered 73 Chinook, of which 38 were retained (all marked) and 35 released (25 marked (2 legal-size) and 10 unmarked).

Trends in Angling Effort, CPUE, and Total Chinook Encounters

Angler effort was low to moderate during most weeks of the three-month Area 9 winter selective fishery (**Figure 3**). Angler effort peaked during statistical week 7 (which included the Discovery Bay Salmon Derby) with an estimated total of 1,960 angler trips taken. The second highest effort week occurred just after the fishery opened (statistical week 3, **Appendix B**) with an estimated 816 trips taken by participating anglers. The lowest level of effort was observed during week 12 (late March, 136 completed angler trips).

Similarly, private fleet catch per unit of effort (CPUE, Chinook retained per angler trip) was moderate throughout the fishery, with a season-wide CPUE of 0.20. At 0.57 Chinook retained per trip, CPUE peaked early on in the fishery (weeks 5 and 6) for this group of anglers (**Figure 4**). The lowest CPUE observed for private fleet anglers occurred during week 8 and week 15, with approximately one in ten anglers (CPUE = 0.11) successfully catching and retaining

Chinook during each week. As expected, charter anglers experienced a higher CPUE during the fishery (0.76 Chinook retained per trip) with the highest catch rates occurring in weeks 7 (CPUE = 0.85) and 8 (CPUE = 1.2).

Over the course of the fishery, anglers retained an average of 98 Chinook and released an average of 152 Chinook per week during in Area 9. The highest week for encounters was statistical week 7 (includes the Discovery Bay Derby stratum), during which an estimated at 826 Chinook (323 retained and 503 released) were encountered (**Figure 5**). The fewest number of encounters per week occurred during the final week (18), when only 54 (21 retained and 33 released; **Figure 5**). Additionally, two charter operators who fished in the Area 9 winter selective fishery encountered a total of 84 Chinook (38 retained 35 released) over the three-month Area 9 winter selective fishery.

Table 4. Estimates of total fishing effort and the total number of salmon kept and released during the winter 2008 Area 9 selective fishery. Values may not add exactly due to rounding error.

Month	Date Range	Angler Category	Effort ¹		Retained Catch ¹		Released Salmon ²		Total
			Boats	Anglers	AD Chinook	UM Chinook	AD Chinook	UM Chinook	
JAN	1/16 -2/3	Private	765	1,448	443	3	470	213	1,126
		Charter	1	3	1	0	2	1	4
FEB	2/4 - 3/2	Private	1,729	3,380	607	0	649	297	1,553
		Charter	19	29	23	0	18	7	48
MAR	3/3 - 3/30	Private	460	941	172	0	183	84	437
		Charter	3	10	11	0	3	1	15
APR	3/31-4/15	Private	579	1,068	149	0	159	73	381
		Charter	3	8	3	0	0	3	6
Creel subtotal:			3,533	6,837	1,371	3	1,461	667	3,497
Charter subtotal:			26	50	38	0	23	12	73
Grand Total:			3,559	6,887	1,409	3	1,484	679	3,570
Standard Error:			232	427	179	2	418	177	720
CV (%):			7%	6%	13%	61%	28%	26%	20%
95% CI:			3,104-4,014	6,050-7,724	1,058-1,760	1-7	665-2,303	331-1,026	2,159-4,981

¹ Estimated boats, anglers, and retained salmon catch were estimated via the Murthy estimator method

² Released Chinook were estimated as the difference between total Chinook encounters generated using a bias-corrected "Method 2" estimator. See **Appendix A** and Conrad and McHugh (2008) for additional details.

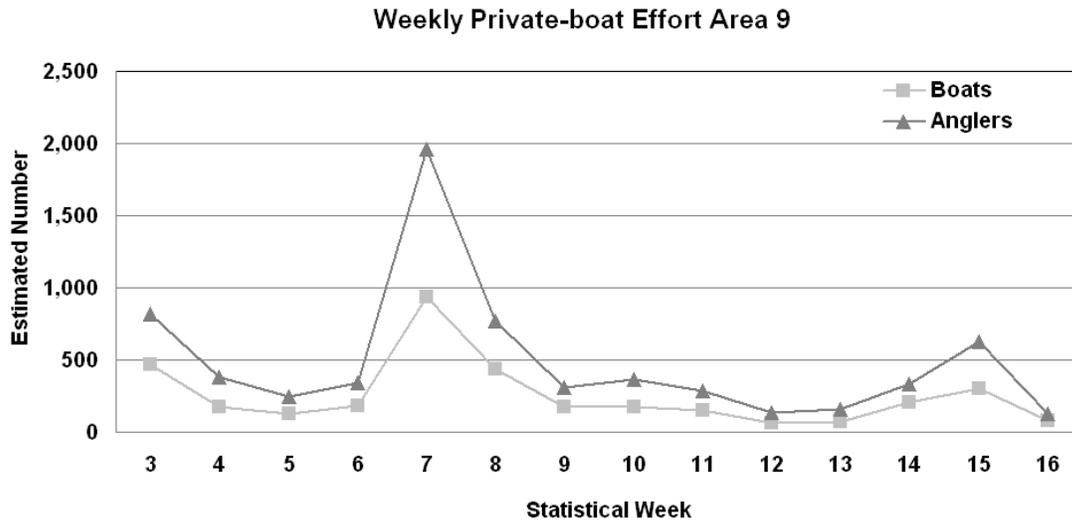


Figure 3. Temporal patterns in fishing effort during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery. See the WDFW statistical week calendar in **Appendix B** for day and month equivalents to plotted statistical weeks.

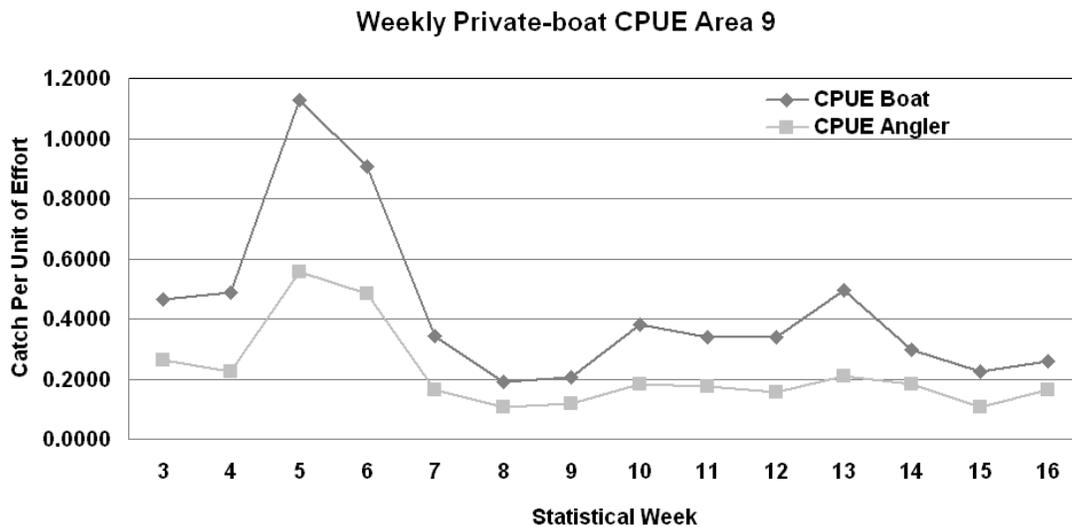


Figure 4. Temporal patterns in CPUE (landed Chinook per angler or boat trip) during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery. See the WDFW statistical week calendar in **Appendix B** for day and month equivalents to plotted statistical weeks.

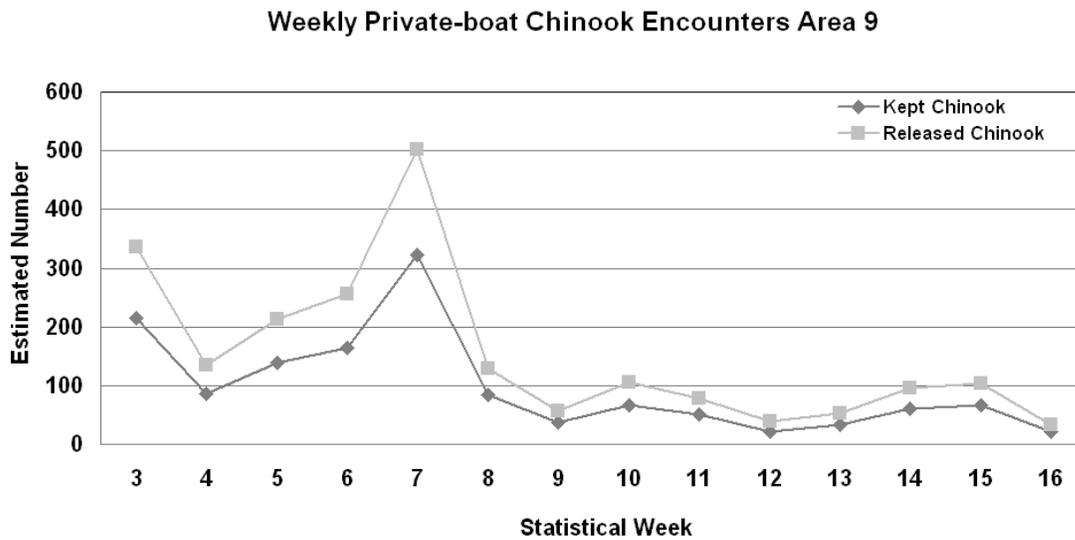


Figure 5. Temporal patterns in total Chinook harvest, releases, and encounters during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery. See the WDFW statistical week calendar in **Appendix B** for day and month equivalents to plotted statistical weeks.

Characteristics of Harvested Chinook

Over the three month Area 9 winter selective fishery 229 Chinook salmon were sampled dockside (227 marked, 1 unmarked and 1 undetermined) (**Table 5**). All of the fish sampled were measured and examined for the presence of a Coded Wire Tag (CWT). Retained Chinook ranged from 52.9 to 92.3 cm in total length and averaged 65.6 cm (SD = 7.3) (**Figure 6**). Twelve of the 229 (5%) retained Chinook sampled were sublegal in size. The average length of the sublegal-size fish kept was 54.3 cm suggesting that was a slight measurement error with retained fish averaging just over 1 cm under the legal size limit (56 cm).

Scale samples were collected from all Chinook sampled ($n = 229$), however, only 214 were aged (93%). Of the 213 marked Chinook sampled and aged, there was almost an even split between age-3 and age-4 fish. Thus, 55% and 45% of harvested Chinook were from brood years 2005 and 2004, respectively (**Appendix G**). Nearly 10% of the fish harvested came from delayed release (i.e., ocean entry at age 2) programs.

Table 5. Summary of length samples collected during dockside angler interviews from retained Chinook salmon, Area 9, January 16 – April 15, 2008.

Mark Type	Number Sampled		Total
	Legal-size	Sublegal-size	
Marked	215	12	227
Unmarked	1	0	1
Undetermined	1	0	1
Total	217	12	229

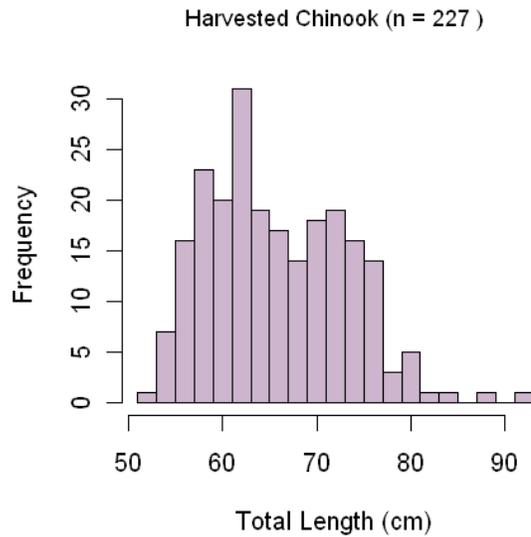


Figure 6. Length-frequency distribution of retained marked Chinook sampled at dockside during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery.

CWT Samples

Samplers recovered a total of 24 coded wire tags from the 227 marked Chinook sampled at dockside (**Table 6, Appendix H**). The majority of these CWTs (22 or 92%) were from Puget Sound or Hood Canal release sites. Two of the tags were from the Chilliwack River Hatchery in the Fraser River Basin in British Columbia, Canada. Nine, five, and six of the 20 Puget Sound CWT recoveries were from release sites located in north, central, and south Puget Sound basins, respectively, whereas only 2 were from Hood Canal release sites. Of the 24 recoveries, half were associated with a double-index (DIT) group (See Overall Fishery Impacts: Estimated CWT-DIT Impacts for estimated unmarked DIT mortality results).

Table 6. Summary of coded-wire tags recovered from Chinook salmon harvested during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery. The field “No. DITs” corresponds to the number of tags that belonged to double-index tag groups.

Release Region ¹	Release Site	Rearing Location	CWT's Recovered	No. DIT's
British Columbia-Fraser R.	Chilliwack River	Chilliwack River Hatchery	2 (8.3%)	2
Hood Canal	Finch Creek	Hoodsport Hatchery	1 (4.8%)	
	Purdy Creek	George Adams Hatchery	1 (4.8%)	1
Puget Sound-Central	Big Soos Creek	Soos Creek Hatchery	1 (4.8%)	1
	Gorst Creek	Gorst Creek Rearing Pond	1 (4.8%)	
	Green River	Icy Creek Hatchery	1 (4.8%)	
	Grovers Creek	Grovers Creek Hatchery	1 (4.8%)	1
	Grovers Creek Hatchery	Grovers Creek Hatchery	1 (4.8%)	1
Puget Sound-North	Cascade River	Marblemount Hatchery	3 (12.5%)	2
	N.F. Nooksack River	Kendall Creek Hatchery	1 (4.8%)	1
	Wallace River	Wallace River Hatchery	3 (2.5%)	2
	Whitehorse Springs	Whitehorse Pond	2 (8.3%)	
Puget Sound-South	Chambers Creek	Chambers Creek + Garrison Hatcheries	1 (4.8%)	
	Clear Creek	Nisqually Hatchery	1 (4.8%)	1
	Cowskull Acclimation Pond	Cowskull Acclimation Pond	2 (8.3%)	
	Voight Creek	Voights Creek Hatchery	2 (8.3%)	
Grand Total			24	12

¹Unofficial release regions. Puget Sound regions were designated based on the WDFW marine catch area containing the river/stream network where juvenile releases originated (i.e., Areas 11 and 13 = South; Areas 9 and 10 = Central; and Areas 7, 8-1, and 8-2 = North).

Test Fishing Results

Gear Types and Fishing Time

Based on angler responses to our fishing method interview question, Area 9 test boat samplers successfully replicated the fishing methods used by the private fleet. Downrigger trolling was the predominant method used by both the private fleet and test fishers. Two hundred and twenty-eight of 266 (85.7%) boats reporting successful Chinook encounters indicated that they used downriggers to encounter Chinook. The weight and bait (“mooching”) technique was the second most frequently used approach, based on interviews (9% of responses; **Table 7**). Test fishers fished using downriggers 74% of the time and the weight and bait for the remainder (26%).

Table 7. Fishing methods employed by private recreational anglers (from dockside interviews, based on number of boat trips sampled, $n = 266$) and test fishers (based on hours fished, $n = 240$) during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery.

Stat Week	DR		WB		Diver		Jig		Other	
	Test Boat	Fleet	Test Fishery	Fleet	Test Fishery	Fleet	Test Fishery	Fleet	Test Fishery	Fleet
3	100.0%	82.8%	0.0%	13.8%	0.0%	0.0%	0.0%	3.4%	0.0%	0.0%
4	100.0%	73.3%	0.0%	20.0%	0.0%	0.0%	0.0%	6.7%	0.0%	0.0%
5	100.0%	87.5%	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	66.3%	89.5%	33.7%	5.3%	0.0%	0.0%	0.0%	5.3%	0.0%	0.0%
7	38.5%	92.1%	61.5%	4.5%	0.0%	2.2%	0.0%	1.1%	0.0%	0.0%
8	51.0%	78.1%	49.0%	9.4%	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%
9	29.5%	69.2%	70.5%	23.1%	0.0%	0.0%	0.0%	7.7%	0.0%	0.0%
10	100.0%	87.5%	0.0%	6.3%	0.0%	0.0%	0.0%	6.3%	0.0%	0.0%
11	71.6%	88.9%	28.4%	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12	80.2%	25.0%	19.8%	50.0%	0.0%	0.0%	0.0%	25.0%	0.0%	0.0%
13	70.4%	100.0%	29.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
14	72.7%	92.3%	27.3%	0.0%	0.0%	0.0%	0.0%	7.7%	0.0%	0.0%
15	55.7%	90.9%	44.3%	9.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	74.0%	85.7%	26.0%	9.0%	0.0%	0.8%	0.0%	4.5%	0.0%	0.0%

Test fishers attempted to fish 5 days per week during the course of the Area 9 winter selective fishery. However, poor weather conditions were a limiting factor on a number of scheduled sample days. Test fishers averaged 17 hours per week of fishing time over the course of the fishery (**Table 8**), fished on 51 of a total of 64 possible fishing days (excluding holidays and weekends), and logged over 240 hours of fishing time.

Chinook Encounters and Mark Rates

During the Area 9 winter selective fishery, test fishers encountered a total of 94 Chinook (40 legal-sized and marked [LM], 8 legal-sized and unmarked [LU], 36 sublegal-sized and marked [SM], and 10 sublegal-sized and unmarked [SU]; **Table 8**). Eighty-one percent of all test fishery Chinook encounters were marked and 42.6% of all encounters were of legal size (≥ 22 in [56 cm]) and marked. Mark rates were similar for sublegal-sized fish, with SM comprising 38.3% of all encounters. With low weekly sample sizes and the majority (80%) of all test fishery encounters occurring during the first half of the fishery, it was not possible to assess mark rate patterns on a time-scale finer than the entire season. Thus, we estimated the size/mark-status composition of the fishery using the pooled dataset (**Table 8**).

Table 8. Composition of test fishery Chinook encounters and associated mark-rate and size/mark-status proportion estimates (SE = standard error) for the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery.

Stat Week	Fishing Effort		Legal		Sublegal		Total
	Days	Hours Fished	AD	UM	AD	UM	
3	2	13.3	5	2	8	2	17
4	4	25.5	5	2	12	4	23
5	3	12.8	3	0	2	1	6
6	3	7.7	2	0	2	0	4
7	5	24.7	14	1	5	1	21
8	4	12.8	1	1	1	1	4
9	5	18.7	1	0	1	0	2
10	4	22.1	2	1	2	0	5
11	4	22.9	5	0	2	0	7
12	4	14.8	1	1	0	0	2
13	2	6.8	0	0	0	0	0
14	5	21.1	1	0	1	0	2
15	5	33.2	0	0	0	1	1
16	1	4	0	0	0	0	0
Totals	51	240.4	40	8	36	10	94
Size/mark-status composition: 0.426 (0.003) 0.085 (0.001) 0.383 (0.003) 0.106 (0.001) Legal size mark rate: 0.83 (0.00) Overall mark rate: 0.81 (0.00)							

Based on the voluntary trip reports (VTRs) returned by private anglers ($n = 25$ angler trips and 23 encounters; **Table 9**) and charter operators ($n = 50$ angler trips and 73 encounters; **Table 4**) participating in the Area 9 fishery, test fishers observed mark rates that were consistent with those experienced by the fleet. Private anglers reported 19 marked encounters, yielding an 82.6% mark rate; charter operators reported 61 marked encounters, yielding an 83.6% mark rate; and test fishers had 76 marked encounters, yielding an 80.9% mark rate.

Table 9. Total Chinook encountered (retained and released) by anglers reporting their catch on voluntary trip reports (VTRs), with estimates of legal, sublegal, and overall mark rates.

Size Class	Mark Status	January (4 VTR's)	February (4 VTR's)	March (3 VTR's)	April (0 VTR's)	Total
Legal	Marked	3	7	2	0	12
	Unmarked	0	1	2	0	3
					% Marked:	80.0%
Sublegal	Marked	6	0	1	0	7
	Unmarked	0	0	1	0	1
					% Marked:	87.5%
Total		9	8	6	0	23
					% Marked:	82.6%

Chinook Size and Age

An analysis of the total lengths collected by test fishers in the Area 9 winter selective fishery showed that the Chinook encountered were evenly split between legal and sublegal size (51% legal). Chinook encounters averaged 56.6 cm total length and there was no significant difference in size between marked and unmarked encounters (56.2 cm marked mean vs. 57.1 unmarked mean; **Figure 7**). Given the abundance of sublegal-sized Chinook in the test fishery, the average size of Chinook retained by private anglers was significantly larger than that of test fishery encounters (TF = 56.6 cm, Private = 65.6 cm). Test fishery-sampled Chinook scales indicated that 89% of the marked and 81% of the Chinook encountered were from brood year 2005 (i.e., age 3; **Appendix G**). Approximately 5% of the marked encounters were yearling outmigrants.

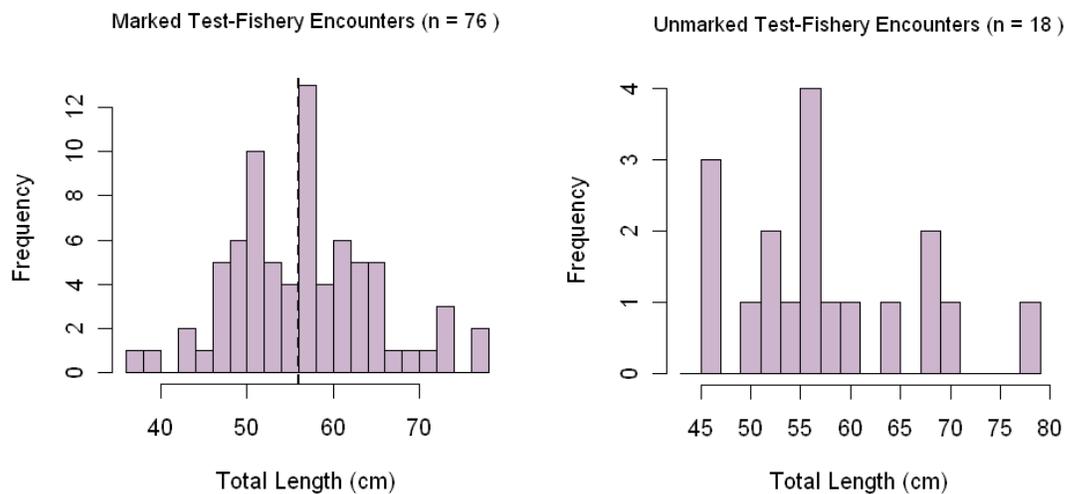


Figure 7. Length-frequency distributions of marked (*left panel*) and unmarked (*right panel*) Chinook encountered by test fishers during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery.

Other Fish Species Encountered

Even though test fishers targeted Chinook salmon during the Area 9 winter selective fishery, they also encountered ten other species of fish (**Table 10**). The two most frequently encountered non-target species were Pacific sandab and rock sole.

Table 10. Test fishery catches of species other than Chinook salmon during the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery.

TOTALS FOR OTHER SPECIES ENCOUNTERED	
Area-9 Test Fishery	
Species	Total Catch
Whitespotted Greenling (<i>Hexagrammos stelleri</i>)	4
Copper rockfish (<i>Sebastes caurinus</i>)	2
Lingcod (<i>Ophiodon elongatus</i>)	1
Dogfish shark (<i>Squalus acanthias</i>)	4
Pacific Staghorn sculpin (<i>Leptocottus armatus</i>)	1
Redtail surfperch (<i>Cymatogaster aggregata</i>)	1
Great Sculpin (<i>Myoxocephalus polyacanthocephalus</i>)	4
Ratfish (<i>Hydrolagus collieli</i>)	1
Pacific sanddab (<i>Citharichthys sordidus</i>)	14
Rock sole (<i>Lepidopsetta bilineata</i>)	44
GRAND TOTAL	76

Overall Fishery Impacts

Total Encounters and Mortalities

Based on the combination of dockside sampling results (**Table 4**), test fishery size/mark-status composition data (**Table 8**), and censused charter catch, we estimated that 1,528 legal-marked, 307 legal-unmarked, 1,360 sublegal-marked, and 375 sublegal-unmarked Chinook salmon were encountered by anglers fishing in the Area 9 winter selective fishery from January 16 – April 15, 2008 (**Table 11, Table 12**). Encounters were primarily marked Chinook comprising 81% (2,888) of the total for the fishery. Anglers released less 0.5 unmarked Chinook (0.48) for every retained marked Chinook.

Given the assumed mortality rates of 0.20 for sublegal-size and 0.15 for legal-size Chinook salmon, we also estimated that 29 legal-marked, 46 legal-unmarked, 258 sublegal-marked, and 75 sublegal-unmarked (408 overall) Chinook were killed due to the effects of handling and release (**Table 11, Table 13**). Adding the release mortality total (408) to the harvest mortality (1,408 retained Chinook) yields a total fishery-related mortality of 1,362 legal-marked, 49 legal-unmarked, 330 sublegal-marked, and 75 sublegal-unmarked Chinook (1,816 overall) for the Area 9 winter selective fishery. Unmarked mortalities totaled 124 for the fishery, which corresponds to 0.09 unmarked mortalities per legal-marked Chinook retained. In addition, given the 94 (40 LM, 8 LU, 36 SM, 10 SU) Chinook caught and released in the Area 9 test fishery, an estimated 16 (13 marked, 3 unmarked) Chinook may have died as a result of our sampling activities.

Table 11. Summary of season-wide fishery impact estimates for the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery. Values may not add up perfectly due to rounding error.

Total Encounters (E): 3,570 var(E): 358,092			(Creel estimates: 1367 Marked Retained + 3 Unmarked Retained + 2127 Released; Charters: 38 Marked Retained + 0 Unmarked Retained + 35 Released)							
Size/mark group	Encounters	# Retained	Num. Rel'd	Rel. Mort. Rate	Rel. Mort.	Total Mortality	Var	SE	95% CI	CV (%)
Legal marked	1,528	1,333	195	0.15	29	1,362	30,975	176	1017 - 1707	13
Legal unmarked	307	3	303	0.15	46	49	308	18	14 - 83	36
Sublegal marked	1,360	72	1,288	0.20	258	330	4,749	69	195 - 465	21
Sublegal unmarked	375	0	375	0.20	75	75	714	27	23 - 127	36
All groups combined	3,570	1,408	2,162		408	1,816	36,745	192	1440 - 2191	11

FRAM versus Creel Comparison

Preseason Fishery Regulation Assessment Model (FRAM) planning efforts suggested that the Area 9 winter selective fishery would have had a much greater impact on marked and unmarked Chinook than our field estimates indicate actually occurred. Among size/mark-status groups, total legal-marked Chinook encounters (and harvest) was closest to its predicted value at 1,528 (1,938 was FRAM’s prediction). Encounters and mortalities predictions for all other size/mark-status groups were 2 to 4 times greater than what was estimated to have occurred (**Table 12, Table 13, Figure 8**). Observed mark rates were similar to, but slightly larger than those predicted to be present by FRAM. Finally, observed unmarked Chinook impacts (i.e., estimated mortalities; **Table 13**) were less than one fifth of what pre-season modeling indicated.

Table 12. Comparison of modeled (i.e., using FRAM, model run 3907) and estimated total Chinook encounters for the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	Unmark.	2034	614	1420	49
	Mark.	6703	1938	4765	1822
	Total	8737	2552	6185	1871
	% Mark.	76.7	75.9	77.0	97.4
Estimated (Creel) Encounters	Unmark.	682	307	375	3
	Mark.	2889	1528	1360	1405
	Total	3570	1835	1735	1408
	% Mark.	80.9	83.4	78.4	99.8

Table 13. Comparison of modeled (i.e., using FRAM, model run 3907) and estimated total Chinook mortalities for the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery.

Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
	Unmark.	Mark.	Total	Unmark.	Mark.	Total
Total (Landed + Released)	469	4706	5175	124	1692	1816
Released Legal	136	1931	2067	46	29	75
Released Sublegal	284	953	1237	75	258	333
Landed Only	49	1822	1871	3	1405	1408

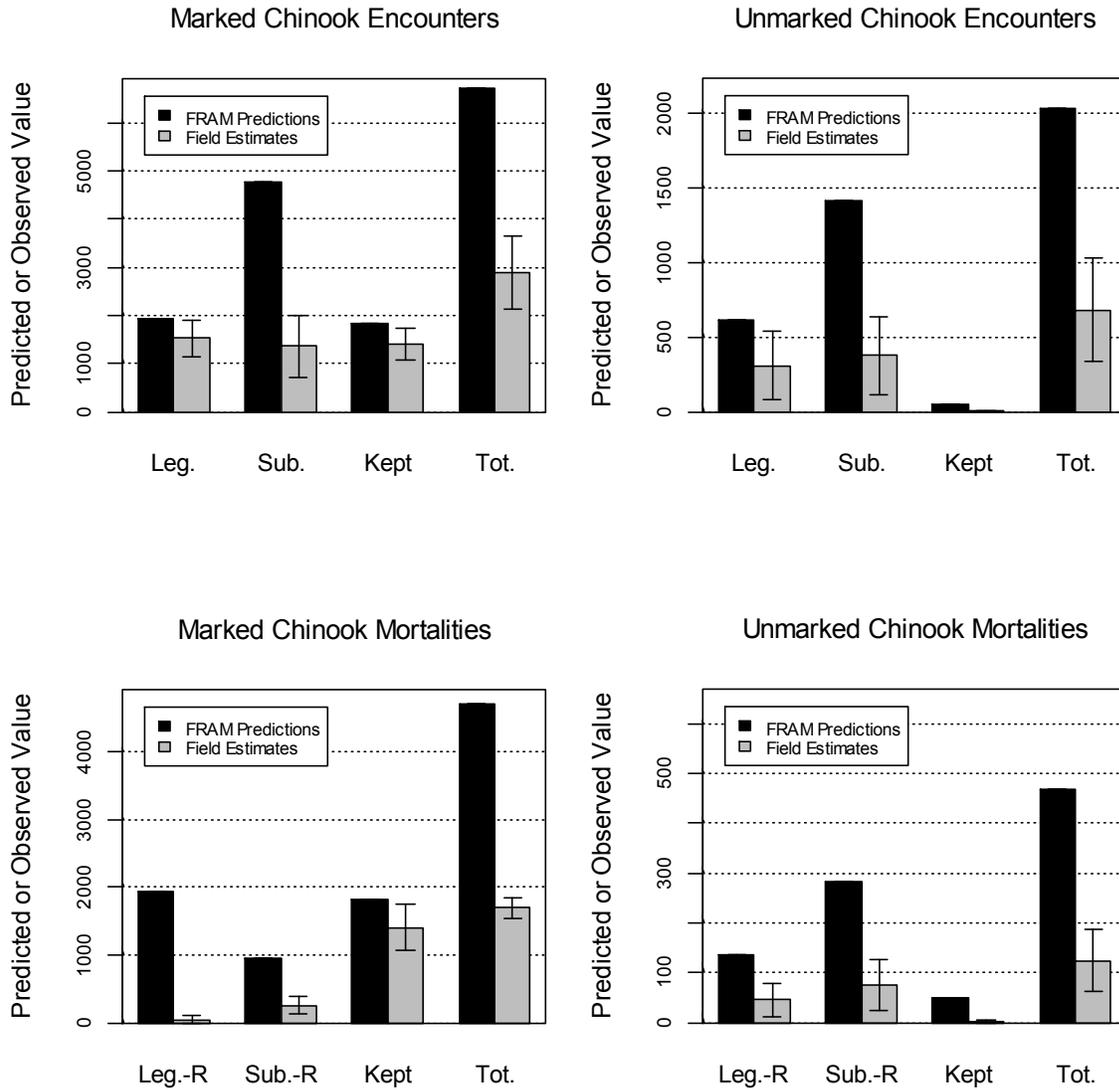


Figure 8. Comparison of modeled (i.e., using FRAM, model run 3907) and estimated total Chinook encounters and mortalities for the Area 9 January 16-April 15, 2008 mark-selective Chinook fishery. Error bars represent approximate 95% confidence intervals for field estimates.

Estimated CWT-DIT Impacts

Of the 24 coded-wire tags recovered during the Area 9 winter mark-selective Chinook fishery, 12 belonged to double-index tag (DIT) release groups (**Table 14**). Based on the release details associated with these tags and their unmarked sister groups, we obtained an estimate of the unmarked-to-marked ratio (λ) at juvenile release for each applicable hatchery of origin and brood year, and we used this value to estimate total unmarked DIT encounters for the entirety of the Area 9 fishery. In total, we estimated that 67 unmarked-DIT Chinook were

caught and released during the fishery. Given an *sfm* rate of 0.10, we estimate that as many as seven of these unmarked-DIT Chinook may have died as a result of the three-month Area 9 winter mark-selective fishery.

Table 14. Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Area 9 mark-selective Chinook fishery that occurred from January 16 through April 15, 2008. AD = marked (i.e., adipose-clipped), UM = unmarked.

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality	
			Est.	var(Est.)		Est.	var(Est.)
George Adams Hatchery	2005	1	5.0	19.70	4.97	0.50	0.20
Grovers Creek Hatchery	2004	1	4.4	14.95	4.97	0.50	0.19
	2005	1	4.4	14.95	3.37	0.34	0.09
H-Chilliwack R. Hatchery	2005	2	8.8	29.90	8.93	0.89	0.31
Kendall Creek Hatchery	2005	1	5.0	19.70	4.98	0.50	0.20
Marblemount Hatchery	2004	2	10.3	44.19	10.17	1.02	0.43
Nisqually Hatchery	2004	1	5.9	29.25	6.00	0.60	0.30
Soos Creek Hatchery	2004	1	13.8	177.81	13.81	1.38	1.77
Wallace R. Hatchery	2004	2	9.4	34.65	9.34	0.93	0.34
TOTAL		12	67.0	385.09	66.55	6.66	3.83

ACKNOWLEDGEMENTS

This review of the winter 2008 Area 9 mark-selective Chinook fishery is a result of the dedicated efforts of several individuals. Steve Axtell (North Sound Sampling Supervisor), Larry Bennett (Peninsula Region Sampling Supervisor), Slim Simpson (Central Sound Sampling Supervisor), and their sampling crews collected creel, test-fishery, and on-the-water survey data throughout the season. Dockside samplers included Jessica Slipper for the West side of Area 9, and Sue Kraemer and Amy Willoughby in Eastern Area 9. Peninsula staff Larry Bennett and Connie Warren as well as Central Sound staff Slim Simpson, Jeff McKee, and Kathy Young-Berg greatly assisted in the summarization and error checking of data, and on other aspects of Area 9 sampling. Steve Axtell and Dean Toba provided much needed on-the-water sampling support and coordination of on-the-water surveys. Pete Sergeef and Courtney Adkins conducted Area 9 test fishing and on-the-water activities throughout the fishery. At the Olympia Headquarters office, Lee Dyer provided substantial help with personnel logistics and support services for the project, Karen Kloempken managed the WDFW sampling databases and provided finalized post-season data, and biologists Mark Baltzell, Peter McHugh, and Laurie Peterson prepared this post-season report.

Finally, this document benefitted greatly from the thorough reviews of Bob Conrad at the Northwest Indian Fisheries Commission and WDFW staff. Their collective critiques helped us to improve the quality of this final draft.

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APPENDICES

Appendix A. Mark-selective fishery impact estimation details.

Below are definitions and equations for all quantities used in estimating mark-selective fishery impacts from the combination of creel survey information, test fishery results, and (where applicable) charter and/or derby accounts. The estimation sequence builds from monthly⁶ estimators of encounters-by-class (i.e., the four size [legal, sublegal] × mark-status [marked, unmarked] groups) to season-wide impact estimates. Where appropriate, the encounters (kept and released) for charter, derby, and/or other fishery components assessed via a complete census (i.e., totals without variance) are simply added to relevant total private-fleet estimates.

A. Total and Class-specific Encounters Estimation

The first step towards quantifying mark-selective fishery impacts by size/mark-status class is to estimate total Chinook encounters (\hat{E}_i , includes retained + released Chinook; See *Monthly Encounters* below) for each month of the fishery. Secondly, encounters are apportioned to the appropriate size/mark-status group using encounters-composition data collected in the test fishery (See *Test-fishery Encounter Composition* on following page).

Monthly Encounters

\hat{E}_i = Total Chinook encounters for month i , which is estimated by combining creel estimates of legal-marked Chinook harvest (\hat{K}_{LMi} , defined on subsequent page) with a test fishery-based estimate of the proportion of the fishable Chinook population that is of legal size and marked (\hat{p}_{LMi} , defined on subsequent page). Given the potential for negative bias in \hat{E}_i if anglers release any of the legal-marked Chinook that they encounter, the \hat{E}_i estimator also includes a “correction” to account for this phenomenon (i.e., $1-p_{LM-R}$, where p_{LM-R} is the estimated legal-marked Chinook release rate)⁷. \hat{E}_i and its variance are estimated as:

$$(1) \quad \hat{E}_i = \frac{K_{LM}}{[\hat{p}_{LM}(1 - p_{LM-R})]}$$

$$(2) \quad \text{var}(\hat{E}_i) = \frac{1}{[(1 - p_{LM-R})^2]} * \left[\frac{\hat{K}_{LMi}^2}{\hat{p}_{LMi}^2} * \left(\frac{\text{var}(\hat{K}_{LMi})}{\hat{K}_{LMi}^2} + \frac{\text{var}(\hat{p}_{LMi})}{\hat{p}_{LMi}^2} \right) \right]$$

⁶ **Note:** For fisheries characterized by short-duration seasons (i.e., ~ 1 month), the “monthly” estimators described in this appendix are synonymous season-total estimators.

⁷ Equations 1 and 2 were modified based on a recent state–tribal evaluation of sources of bias in estimates of total Chinook encounters in mark-selective fisheries. Based on a review of relevant data, the current operational p_{LM-R} (combined intentional and unintentional LM Chinook release rate) applied in the bias-corrected \hat{E}_i estimator is 0.13. See Conrad and McHugh (2008) for further detail.

Test-fishery Encounter Composition

\hat{p}_{LMi} = the test-fishery estimate of the proportion of Chinook encounters that are legal-sized (L) and marked (M) during month i

\hat{p}_{LUi} = the estimated proportion of encounters that are legal-sized (L) and unmarked (U)

\hat{p}_{SMi} = the estimated proportion of encounters that are sublegal-sized (S) and unmarked (M)

\hat{p}_{LUI} = the estimated proportion of encounters that are sublegal-sized (S) and unmarked (U)

For each XY combination (where $X=L$ or S and $Y=M$ or U), \hat{p}_{XYi} and its variance is estimated as:

$$(3) \quad \hat{p}_{XYi} = n_{XYi} / n_i, \text{ and}$$

$$(4) \quad \text{var}(\hat{p}_{XYi}) = [\hat{p}_{XYi}(1 - \hat{p}_{XYi})] / (n_i - 1),$$

where n_i = the total number of fish encountered by test boats during month i .

Encounters by Size/Mark-status Class

\hat{E}_{LMi} = estimated legal (L), marked (M) encounters during month i

\hat{E}_{LUI} = estimated legal (L), unmarked (U) encounters during month i

\hat{E}_{SMi} = estimated sublegal (S), marked (M) encounters during month i

\hat{E}_{SUI} = estimated sublegal (S), marked (U) encounters during month i

For each XY combination (where $X=L$ or S and $Y=M$ or U) excluding LM , \hat{E}_{XYi} and an estimate of its variance are obtained from:

$$(5) \quad \hat{E}_{XYi} = \hat{E}_i * \hat{p}_{XYi}$$

$$(6) \quad \text{var}(\hat{E}_{XYi}) = \text{var}(\hat{E}_i) * \hat{p}_{XYi}^2 + \hat{E}_i^2 * \text{var}(\hat{p}_{XYi}) - \text{var}(\hat{E}_i) * \text{var}(\hat{p}_{XYi})$$

Since the \hat{E}_{LMi} estimate derived according to Eqn. 5 above is equivalent to that obtained by expanding \hat{K}_{LMi} by the constant $1 - p_{LM=R}$, its variance is estimated as:

$$(7) \quad \text{var}(\hat{E}_{LMi}) = \text{var}(\hat{K}_{LMi}) / (1 - \hat{p}_{LM=R})^2$$

B. Estimating Retained and Released Numbers by Size/Mark-status Class

Before total mortality can be estimated for each class (LM, SM, LU, SU), class-specific encounters must be separated into retention and release categories. First, given that harvest is estimated only to mark-status class for creel survey purposes (i.e., Murthy estimates or otherwise), estimates of marked

and unmarked Chinook retention must be assigned to size classes (See *Apportioned Estimates of Retention to Size Classes* on subsequent page); this is done using mark-status-specific size composition data from dockside sampling (See *Dockside Observations for Apportioning Retained Catch to Class* on subsequent page). Subsequently, size/mark-status group-specific releases are estimated as the difference between class-specific encounters and retention (See *Estimating Release Numbers by Class* on subsequent page).

Dockside Observations for Apportioning Retained Catch to Class

\hat{d}_{LMK} = the estimated proportion of retained (kept, K), marked (M) Chinook salmon that were legal (L); based on *season-wide*⁸ dockside observations of marked Chinook (as is \hat{d}_{SMK})

\hat{d}_{SMK} = the estimated proportion of retained (kept, K), marked (M) Chinook that were sublegal (S)

The proportion of retained, marked fish in size class X ($X = L$ or S) and its variance are estimated as:

$$(8) \quad \hat{d}_{XMK} = n_{XMK} / n_{MK}$$

$$(9) \quad \text{var}(\hat{d}_{XMK}) = [\hat{d}_{XMK} * (1 - \hat{d}_{XMK})] / (n_{MK} - 1),$$

where n_{MK} and n_{XMK} are *season-wide* total dockside counts of marked fish and the subset of marked fish in size-class X , respectively.

\hat{d}_{LUK} = the estimated proportion of retained (kept, K), unmarked (U) Chinook salmon that are legal (L); estimated from *season-wide* dockside observations of unmarked Chinook (as is \hat{d}_{SUK})

\hat{d}_{SUK} = the estimated proportion of retained (kept, K), unmarked (U) Chinook that are sublegal (S)

The proportions of retained, unmarked fish belonging to legal and sublegal size classes and their respective variances are estimated as above (Eqns. 8 and 9) but using *season-wide* dockside observations on unmarked (U), not marked Chinook salmon.

Apportioned Estimates of Retention to Size Classes

\hat{K}_{LMi} = the estimated number of legal (L), marked (M) Chinook kept in month i

\hat{K}_{LUi} = the estimated number of legal (L), unmarked (U) Chinook kept in month i

The number of kept, marked encounters, marked fish in size class X (L or S) and its variance is estimated as:

$$(10) \quad \hat{K}_{XMi} = \hat{d}_{XMK} * \hat{N}_{MKi}$$

$$(11) \quad \text{var}(\hat{K}_{XMi}) = \text{var}(\hat{K}_{XMi}) * \hat{d}_{XMK}^2 + \hat{N}_{MKi}^2 * \text{var}(\hat{d}_{XMK}) - \text{var}(\hat{N}_{MKi}) * \text{var}(\hat{d}_{XMK})$$

⁸ Due to small sample sizes for observed, harvested Chinook—particularly for sublegal and/or unmarked classes—dockside length data are pooled across the season to estimate \hat{d}_{XYK} .

where \hat{d}_{xMK} and its variance are from 7 and 8 above and \hat{N}_{MKi} is the survey estimate of retained marked fish for month i defined in Eqn. 1.

\hat{K}_{SMi} = estimated number of sublegal (S), marked (M) Chinook kept in month i

\hat{K}_{SUi} = estimated number of sublegal (S), unmarked (U) Chinook kept in month i

The number of retained, unmarked fish belonging to legal and sublegal size classes is estimated according to Eqns. 10 and 11 above but using unmarked fish proportions and monthly retention estimates.

Estimating Release Numbers by Class

\hat{R}_{LMi} = the estimated number of legal (L), marked (M) Chinook released in month i

\hat{R}_{LUi} = the estimated number of legal (L), unmarked (U) Chinook released in month i

\hat{R}_{SMi} = the estimated number of sublegal (S), marked (M) Chinook released in month i

\hat{R}_{SUi} = the estimated number of sublegal (S), unmarked (U) Chinook released in month i

For each size/mark-status class (i.e., XY combination [$X=L$ or S and $Y=M$ or U]), the number of fish encountered and released is estimated as the difference between total size/mark-status class encounters (\hat{E}_{XYi}) and retention (\hat{K}_{XYi}) during month i . The estimator and its variance are:

$$(12) \quad \hat{R}_{XYi} = \hat{E}_{XYi} - \hat{K}_{XYi}$$

$$(13) \quad \text{var}(\hat{R}_{XYi}) = \text{var}(\hat{E}_{XYi}) + \text{var}(\hat{K}_{XYi})$$

C. Estimating Total (and Class-specific) Monthly and Season-wide Mortality

The application of assumed mortality rates (See *Assumed Mortality Rates for Retained and Released Chinook* below) to class-specific estimates of total retention and releases constitutes the final step in quantifying mark-selective fishery impacts.

Assumed Mortality Rates for Retained and Released Chinook

m_K = retention mortality rate, 100% for all retained Chinook (reincarnation is rare among fishes)

sfm_L = release mortality rate for legal (L) Chinook, assumed to be a constant 15%

sfm_S = release mortality rate for sublegal (S) Chinook, assumed to be a constant 20%

Retention-mortality Estimates

\hat{M}_{LMKi} = estimated mortality due to legal (L), marked (M) Chinook harvest in month i ($=\hat{K}_{LMi}$).

\hat{M}_{LUKi} = estimated mortality due to harvest of legal (L), unmarked (U) Chinook in month i ($=\hat{K}_{LUi}$).

\hat{M}_{SMKi} = estimated mortality due to harvest of sublegal (*S*), marked (*M*) Chinook in month *i* ($= \hat{K}_{SMi}$).
 \hat{M}_{SUKi} = estimated mortality due to harvest of sublegal (*S*), marked (*M*) Chinook in month *i* ($= \hat{K}_{SUi}$).

Release-mortality Estimates

\hat{M}_{LMRi} = estimated post-release mortality for legal (*L*), marked (*M*) Chinook in month *i*
 \hat{M}_{LURi} = estimated post-release mortality for legal (*L*), unmarked (*U*) Chinook in month *i*
 \hat{M}_{SMRi} = estimated post-release mortality for sublegal (*S*), marked (*M*) Chinook in month *i*
 \hat{M}_{SURi} = estimated post-release mortality for sublegal (*S*), unmarked (*U*) Chinook in month *i*

All class-specific (*XY* [*X* = *L* or *S*, *Y* = *M* or *U*]) release mortality estimates are obtained from:

$$(14) \quad \hat{M}_{XYRi} = \hat{R}_{XYi} * sfm_Y$$

$$(15) \quad \text{var}(\hat{M}_{XYRi}) = \text{var}(\hat{R}_{XYi}) * sfm_Y^2$$

Season-wide Total and Class-specific Mortality Estimation

\hat{M}_{total} = total season-wide Chinook salmon mortality; this parameter and its variance [$\text{var}(\hat{M}_{total})$] are computed as the sum of all monthly retention and release mortality estimates [i.e., $\hat{M}_{total} = \sum_{i=1}^{\max i} (\hat{M}_{XYKi} + \hat{M}_{XYRi})$] and variances [$\text{var}(\hat{M}_{total}) = \sum_{i=1}^{\max i} [\text{var}(\hat{M}_{XYKi}) + \text{var}(\hat{M}_{XYRi})]$], respectively, for all four size/mark-status groups (*X* = *L* or *S*, *Y* = *M* or *U*). Season total estimates for subgroups of interest (e.g., unmarked, sublegal Chinook, $\hat{M}_{SU-total}$) are obtained by summing monthly estimates (and variances) across the season for just that group.

D. Characterizing Precision of Estimates

The precision of estimates generated from creel surveys and the preceding fishery impact estimation scheme is characterized using estimates of a parameter's standard error (*SE*), coefficient of variation (*CV* or relative standard error), and approximate 95% confidence interval. For any parameter estimate $\hat{\theta}$ (e.g., \hat{M}_{total} , \hat{K}_{LMi} , \hat{E}_i , etc.), these metrics are estimated using:

$$(16) \quad SE(\hat{\theta}) = \sqrt{\text{var}(\hat{\theta})}$$

$$(17) \quad CV(\hat{\theta}) = [SE(\hat{\theta}) / \hat{\theta}] * 100$$

$$(18) \quad CI = \hat{\theta} \pm 1.96 * SE(\hat{\theta})$$

Figure A1. (*On following page*) Graphical representation of the approach used to estimate monthly encounters and mortalities by size/mark-status category in mark-selective Chinook fisheries. Boxes depict abundance estimates (encounters, mortalities) whereas the mathematical operations depicted on intermediate connector lines are estimator formulae yielding quantities found in subsequent boxes (moving from left to right). Parameter definitions, complete formulae, and variances are defined in the preceding pages. For short-duration fisheries (~ 1 month or less), monthly and season-total values are equivalent; for all others, season-total impacts are equivalent to the sum of monthly impact estimates (and variances).

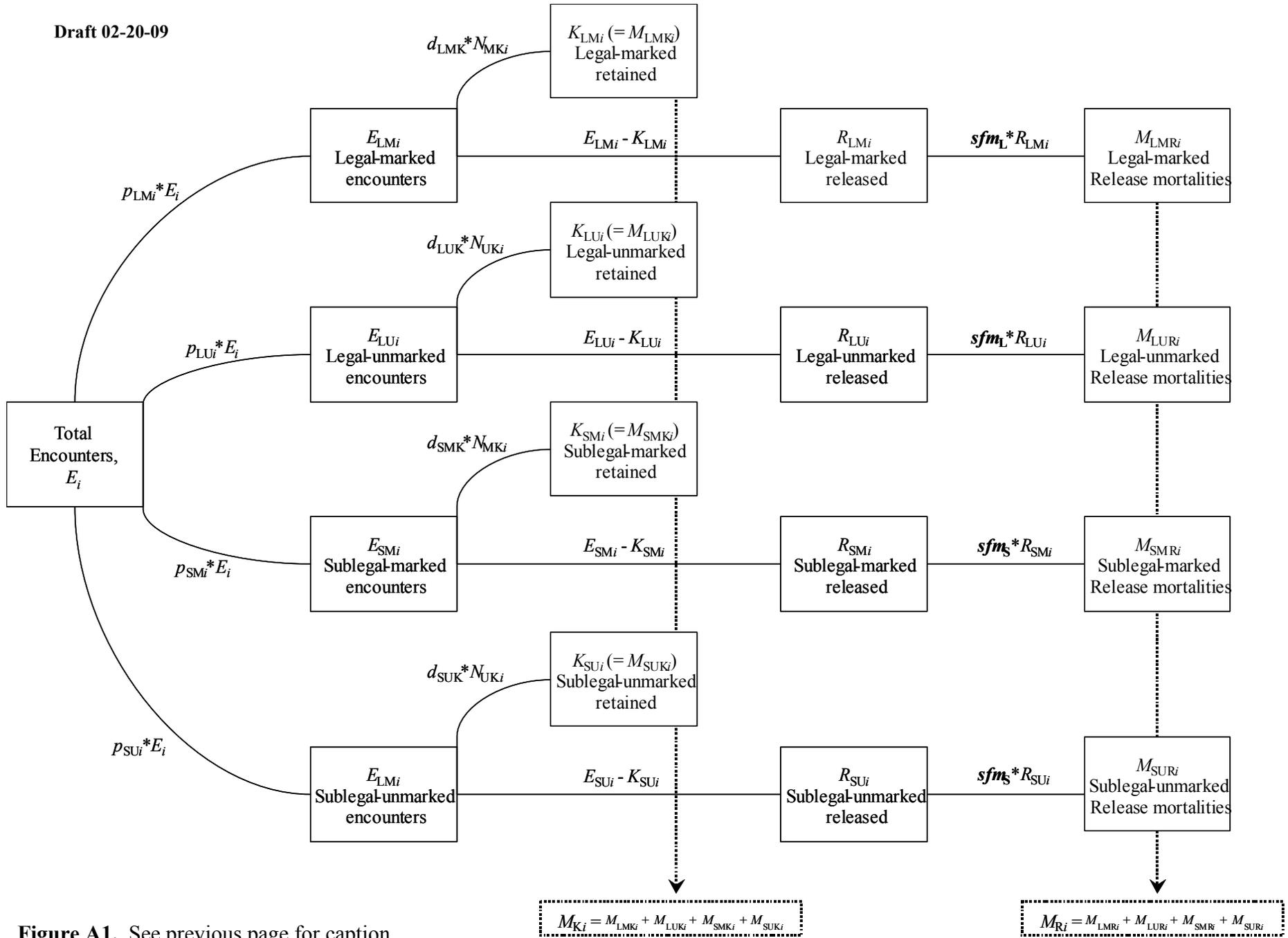


Figure A1. See previous page for caption.

Appendix B. 2008 statistical weeks used by Washington Department of Fish and Wildlife.

Stat Month	Week #	Start Date	End Date	Stat Month	Week #	Start Date	End Date
1	1	01-Jan	06-Jan	7	27	30-Jun	06-Jul
	2	07-Jan	13-Jan		28	07-Jul	13-Jul
	3	14-Jan	20-Jan		29	14-Jul	20-Jul
	4	21-Jan	27-Jan		30	21-Jul	27-Jul
	5	28-Jan	03-Feb		31	28-Jul	03-Aug
2	6	04-Feb	10-Feb	8	32	04-Aug	10-Aug
	7	11-Feb	17-Feb		33	11-Aug	17-Aug
	8	18-Feb	24-Feb		34	18-Aug	24-Aug
	9	25-Feb	02-Mar		35	25-Aug	31-Aug
3	10	03-Mar	09-Mar	9	36	01-Sep	07-Sep
	11	10-Mar	16-Mar		37	08-Sep	14-Sep
	12	17-Mar	23-Mar		38	15-Sep	21-Sep
	13	24-Mar	30-Mar		39	22-Sep	28-Sep
4	14	31-Mar	06-Apr	10	40	29-Sep	05-Oct
	15	07-Apr	13-Apr		41	06-Oct	12-Oct
	16	14-Apr	20-Apr		42	13-Oct	19-Oct
	17	21-Apr	27-Apr		43	20-Oct	26-Oct
	18	28-Apr	04-May		44	27-Oct	02-Nov
5	19	05-May	11-May	11	45	03-Nov	09-Nov
	20	12-May	18-May		46	10-Nov	16-Nov
	21	19-May	25-May		47	17-Nov	23-Nov
	22	26-May	01-Jun		48	24-Nov	30-Nov
6	23	02-Jun	08-Jun	12	49	01-Dec	07-Dec
	24	09-Jun	15-Jun		50	08-Dec	14-Dec
	25	16-Jun	22-Jun		51	15-Dec	21-Dec
	26	23-Jun	29-Jun		52	22-Dec	28-Dec
						53	29-Dec

Appendix C. Sample rates in the Area 9 (January 16-April 15, 2008) selective Chinook fishery.

Time period			Estimated Retained Chinook				Number of Chinook sampled				Sample Rate (%)
Month	Stat. Weeks	Range	Marked	Unmark	Unk.	Total	Marked	Unmark	Unk.	Total	
January	3-5	Jan 16-Feb 3	440	3	0	443	32	0	0	32	7.2%
February	6-9	Feb 4-Mar 2	607	0	0	607	136	1	1	138	22.7%
March	10-13	Mar 3-30	172	0	0	172	29	0	0	29	16.9%
April	14-16	Mar 31-Apr 15	149	0	0	149	30	0	0	30	20.1%
Season Total Values:			1,368	3	0	1,371	227	1	1	229	16.7%

Appendix D. Fishery total estimates of retained and released salmon (Chinook and other species) catch for the Area 9 January 16 – April 15, 2008 mark selective Chinook Fishery. Displayed Chinook harvest values are equivalent to those displayed in **Table 4**. Whereas the Chinook release estimates displayed in **Table 4** are based on the Conrad and McHugh (2008) method, values displayed here are based solely on angler reported data. Values may not add exactly due to rounding error.

Stat Week	Est. Retained Catch			Est. Releases			
	Mark	Unmark	Total	Mark	Chinook Unmark	Unk.	Unk Salmon
3	215	0	215	169	153	34	0
4	86	0	86	3	42	9	0
5	139	3	142	64	55	38	0
6	165	0	165	9	146	19	19
7	323	0	323	175	234	82	57
8	83	0	83	50	76	40	0
9	36	0	36	14	0	18	0
10	67	0	67	70	47	9	0
11	50	0	50	9	5	0	0
12	21	0	21	11	11	0	0
13	34	0	34	0	12	0	0
14	61	0	61	14	16	17	0
15	67	0	67	13	32	0	0
16	21	0	21	0	0	0	0
Total	1,368	3	1,371	601	828	268	76
SE	180	2	180	58	115	43	56
CV	13.1%	57.7%	13.1%	9.6%	13.9%	15.9%	73.0%
95% CI	1,342-1,395	1-6	1,345-1,398	586-615	807-849	255-280	61-91

Appendix E. Summary of the total number of anglers intercepted in Area 9 during on-the-water surveys between January 16 and April 15, 2008. Grayed cells represent sites included in the dockside sample frame.

SITE	Total Anglers	Season Total (unadjusted) Size Measure	No. Anglers, Derby Survey	Stratum (unadjusted) Size Measure
Armeni Ramp	4	0.011	2	0.006
Bainbridge (Private)	2	0.005	0	0.000
Bayside Drystack	5	0.013	0	0.000
Beach Launch	3	0.008	0	0.000
Bremerton	1	0.003	0	0.000
Bridgehaven	0	0.000	2	0.006
Brownsville	4	0.011	0	0.000
Coupeville	0	0.000	3	0.008
Driftwood Key Marina	21	0.056	4	0.011
Edmonds Dry Storage	34	0.090	10	0.028
Edmonds Marina	34	0.090	12	0.033
Edmonds Marina Sling	0	0.000	6	0.017
Eglon Ramp	8	0.021	7	0.019
Elliott Bay Marina	0	0.000	2	0.006
Everett Marina	12	0.032	5	0.014
Everett Ramp	44	0.117	36	0.099
Foss Landing	2	0.005	0	0.000
Ft Casey Ramp	28	0.074	30	0.083
Ft Flagler	0	0.000	4	0.011
Ft Worden	0	0.000	13	0.036
Hadlock Ramp	11	0.029	20	0.055
Hadlock Marina	3	0.008	11	0.030
Hanesville	2	0.005	1	0.003
Hudson Point	0	0.000	9	0.025
John Wayne Marina	0	0.000	4	0.011
Kingston	32	0.085	6	0.017
Lagoon Point	1	0.003	0	0.000
Mats Mats Bay Ramp	16	0.042	15	0.041
Max Welton Ramp	2	0.005	2	0.006
Mercer Island Ramp	1	0.003	0	0.000
Mukilteo Ramp	11	0.029	12	0.033
Mutiny Bay	3	0.008	1	0.003
Pleasant Harbor	2	0.005	0	0.000
Possession Point Ramp	3	0.008	0	0.000
Pt Ludlow Marina	4	0.011	2	0.006
Pt Orchard Marina	2	0.005	0	0.000
Pt Townsend BH Marina	12	0.032	67	0.185
Pt Townsend BH Ramp	34	0.090	49	0.135
Private Moorage/Launch	13	0.034	10	0.028
Salsbury Ramp	1	0.003	14	0.039
Sandy Hook (prvt)	5	0.013	2	0.006
Seattle Dry Stack	2	0.005	0	0.000
Shilshole Ramp	11	0.029	1	0.003
Salmon Bay Marina	4	0.011	0	0.000
Total Anglers	377	1.000	362	1.000

Appendix F. Size measures of sites sampled during the Area 9 creel survey, by dockside sample date.

SAMPLEDATE	WEEK	SITESIZE	LOCATIONCODE
01/16/2008	3	0.450	Everett Ramp (10th St)
01/16/2008	3	0.100	Pt. Townsend Boat Haven Ramp
01/18/2008	3	0.450	Everett Ramp (10th St)
01/18/2008	3	0.100	Pt. Townsend Boat Haven Ramp
01/19/2008	3	0.450	Everett Ramp (10th St)
01/19/2008	3	0.100	Pt. Townsend Boat Haven Ramp
01/20/2008	3	0.450	Everett Ramp (10th St)
01/20/2008	3	0.100	Pt. Townsend Boat Haven Ramp
01/24/2008	4	0.450	Everett Ramp (10th St)
01/24/2008	4	0.100	Pt. Townsend Boat Haven Ramp
01/25/2008	4	0.450	Everett Ramp (10th St)
01/25/2008	4	0.100	Pt. Townsend Boat Haven Ramp
01/26/2008	4	0.450	Everett Ramp (10th St)
01/26/2008	4	0.100	Pt. Townsend Boat Haven Ramp
01/27/2008	4	0.450	Everett Ramp (10th St)
01/27/2008	4	0.100	Pt. Townsend Boat Haven Ramp
01/28/2008	5	0.450	Everett Ramp (10th St)
01/28/2008	5	0.100	Pt. Townsend Boat Haven Ramp
01/31/2008	5	0.450	Everett Ramp (10th St)
01/31/2008	5	0.100	Pt. Townsend Boat Haven Ramp
02/01/2008	5	0.450	Everett Ramp (10th St)
02/01/2008	5	0.100	Pt. Townsend Boat Haven Ramp
02/02/2008	5	0.450	Everett Ramp (10th St)
02/02/2008	5	0.100	Pt. Townsend Boat Haven Ramp
02/03/2008	5	0.450	Everett Ramp (10th St)
02/03/2008	5	0.100	Pt. Townsend Boat Haven Ramp
02/04/2008	6	0.450	Everett Ramp (10th St)
02/04/2008	6	0.100	Pt. Townsend Boat Haven Ramp
02/07/2008	6	0.450	Everett Ramp (10th St)
02/07/2008	6	0.100	Pt. Townsend Boat Haven Ramp
02/08/2008	6	0.450	Everett Ramp (10th St)
02/08/2008	6	0.100	Pt. Townsend Boat Haven Ramp
02/09/2008	6	0.450	Everett Ramp (10th St)
02/09/2008	6	0.100	Pt. Townsend Boat Haven Ramp
02/10/2008	6	0.450	Everett Ramp (10th St)
02/10/2008	6	0.100	Pt. Townsend Boat Haven Ramp
02/13/2008	7	0.450	Everett Ramp (10th St)
02/13/2008	7	0.100	Pt. Townsend Boat Haven Ramp
02/14/2008	7	0.450	Everett Ramp (10th St)
02/14/2008	7	0.100	Pt. Townsend Boat Haven Ramp
02/15/2008	7	0.450	Everett Ramp (10th St)
02/15/2008	7	0.100	Pt. Townsend Boat Haven Ramp
02/16/2008	7	0.298	Everett Ramp (10th St)
02/16/2008	7	0.405	Pt. Townsend Boat Haven Ramp
02/17/2008	7	0.298	Everett Ramp (10th St)
02/17/2008	7	0.405	Pt. Townsend Boat Haven Ramp
02/21/2008	8	0.353	Everett Ramp (10th St)
02/21/2008	8	0.147	Pt. Townsend Boat Haven Ramp
02/22/2008	8	0.353	Everett Ramp (10th St)
02/22/2008	8	0.147	Pt. Townsend Boat Haven Ramp
02/23/2008	8	0.353	Everett Ramp (10th St)
02/23/2008	8	0.147	Pt. Townsend Boat Haven Ramp
02/24/2008	8	0.353	Everett Ramp (10th St)

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SAMPLEDATE	WEEK	SITESIZE	LOCATIONCODE
02/24/2008	8	0.147	Pt. Townsend Boat Haven Ramp
02/27/2008	9	0.328	Everett Ramp (10th St)
02/27/2008	9	0.262	Pt. Townsend Boat Haven Ramp
02/28/2008	9	0.328	Everett Ramp (10th St)
02/28/2008	9	0.262	Pt. Townsend Boat Haven Ramp
02/29/2008	9	0.328	Everett Ramp (10th St)
02/29/2008	9	0.148	Kingston Public Ramp
03/01/2008	9	0.262	Edmonds Marina Dry Stack
03/01/2008	9	0.328	Everett Ramp (10th St)
03/02/2008	9	0.328	Everett Ramp (10th St)
03/02/2008	9	0.262	Pt. Townsend Boat Haven Ramp
03/05/2008	10	0.328	Everett Ramp (10th St)
03/05/2008	10	0.262	Pt. Townsend Boat Haven Ramp
03/06/2008	10	0.328	Everett Ramp (10th St)
03/06/2008	10	0.262	Pt. Townsend Boat Haven Ramp
03/07/2008	10	0.328	Everett Ramp (10th St)
03/07/2008	10	0.262	Pt. Townsend Boat Haven Ramp
03/08/2008	10	0.262	Edmonds Marina Dry Stack
03/08/2008	10	0.328	Everett Ramp (10th St)
03/09/2008	10	0.328	Everett Ramp (10th St)
03/09/2008	10	0.262	Pt. Townsend Boat Haven Ramp
03/11/2008	11	0.321	Everett Ramp (10th St)
03/11/2008	11	0.238	Pt. Townsend Boat Haven Ramp
03/12/2008	11	0.321	Everett Ramp (10th St)
03/12/2008	11	0.238	Pt. Townsend Boat Haven Ramp
03/14/2008	11	0.321	Everett Ramp (10th St)
03/14/2008	11	0.226	Kingston Public Ramp
03/15/2008	11	0.214	Edmonds Marina Dry Stack
03/15/2008	11	0.321	Everett Ramp (10th St)
03/16/2008	11	0.321	Everett Ramp (10th St)
03/16/2008	11	0.238	Pt. Townsend Boat Haven Ramp
03/17/2008	12	0.321	Everett Ramp (10th St)
03/17/2008	12	0.238	Pt. Townsend Boat Haven Ramp
03/18/2008	12	0.321	Everett Ramp (10th St)
03/18/2008	12	0.238	Pt. Townsend Boat Haven Ramp
03/21/2008	12	0.214	Edmonds Marina Dry Stack
03/21/2008	12	0.321	Everett Ramp (10th St)
03/22/2008	12	0.321	Everett Ramp (10th St)
03/22/2008	12	0.226	Kingston Public Ramp
03/23/2008	12	0.321	Everett Ramp (10th St)
03/23/2008	12	0.238	Pt. Townsend Boat Haven Ramp
03/26/2008	13	0.312	Everett Ramp (10th St)
03/26/2008	13	0.234	Pt. Townsend Boat Haven Ramp
03/27/2008	13	0.312	Everett Ramp (10th St)
03/27/2008	13	0.299	Kingston Public Ramp
03/28/2008	13	0.156	Edmonds Marina Dry Stack
03/28/2008	13	0.312	Everett Ramp (10th St)
03/29/2008	13	0.312	Everett Ramp (10th St)
03/29/2008	13	0.299	Kingston Public Ramp
03/30/2008	13	0.312	Everett Ramp (10th St)
03/30/2008	13	0.234	Pt. Townsend Boat Haven Ramp
04/01/2008	14	0.312	Everett Ramp (10th St)
04/01/2008	14	0.234	Pt. Townsend Boat Haven Ramp
04/03/2008	14	0.312	Everett Ramp (10th St)
04/03/2008	14	0.299	Kingston Public Ramp
04/04/2008	14	0.312	Everett Ramp (10th St)
04/04/2008	14	0.234	Pt. Townsend Boat Haven Ramp

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SAMPLEDATE	WEEK	SITESIZE	LOCATIONCODE
04/05/2008	14	0.312	Everett Ramp (10th St)
04/05/2008	14	0.299	Kingston Public Ramp
04/06/2008	14	0.312	Everett Ramp (10th St)
04/06/2008	14	0.234	Pt. Townsend Boat Haven Ramp
04/07/2008	15	0.312	Everett Ramp (10th St)
04/07/2008	15	0.234	Pt. Townsend Boat Haven Ramp
04/10/2008	15	0.312	Everett Ramp (10th St)
04/10/2008	15	0.299	Kingston Public Ramp
04/11/2008	15	0.312	Everett Ramp (10th St)
04/11/2008	15	0.234	Pt. Townsend Boat Haven Ramp
04/12/2008	15	0.312	Everett Ramp (10th St)
04/12/2008	15	0.299	Kingston Public Ramp
04/13/2008	15	0.312	Everett Ramp (10th St)
04/13/2008	15	0.234	Pt. Townsend Boat Haven Ramp
04/14/2008	16	0.312	Everett Ramp (10th St)
04/14/2008	16	0.234	Pt. Townsend Boat Haven Ramp
04/15/2008	16	0.312	Everett Ramp (10th St)
04/15/2008	16	0.234	Pt. Townsend Boat Haven Ramp

Appendix G. Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon from Area 9 January 16-April 15, 2008.

Source	Mark-status group	Age ¹ Composition				Total	
		3.1	3.2	4.1	4.2		
Dockside samples	AD	Jan	23	0	7	2	32
		Feb	66	0	52	10	128
		Mar	15	0	8	4	27
		Apr	12	0	10	4	26
		Total	116	0	77	20	213
			(55%)	(0%)	(36%)	(9%)	(100%)
Test Fishery	AD	Jan	25	1	3	0	29
		Feb	28	0	2	0	30
		Mar	8	1	2	1	12
		Apr	1	1	0	0	2
		Total	62	3	7	1	73
			(85%)	(4%)	(10%)	(1%)	(100%)
Test Fishery	UM	Jan	7	0	1	0	8
		Feb	4	0	1	0	5
		Mar	1	0	1	0	2
		Apr	1	0	0	0	1
		Total	13	0	3	0	16
			(81%)	(0%)	(19%)	(0%)	(100%)

¹Gilbert-Rich age notation, "Total Age". "Age at outmigration", inclusive of time spent in incubation.

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Appendix H. CWTs recovered from Chinook salmon during the Area 9 Winter 2008 mark-selective Chinook fishery.

Recov Date	Tag Code	BY	ReleaseSite	RearingHatchery	Release Agency	DIT	FL cm	Recov Mark	Release Mark	Label
04-Apr	633366	05	PURDY CR 16.0005	GEORGE ADAMS HATCHRY	WDFW	DIT: 633365	57	AD Fin Clp	AD Fin Clp	49464
06-Apr	632789	04	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW	DIT: 632788	73	AD Fin Clp	AD Fin Clp	49465
12-Apr	633172	05	NOOKSACK R -NF 01.0120	KENDALL CR HATCHERY	WDFW	DIT: 633171	61	AD Fin Clp	AD+OTOLITH	51370
02-Feb	632876	04	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW		70	AD Fin Clp	AD Fin Clp	44885
02-Feb	632879	04	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		68	AD Fin Clp	AD Fin Clp	54679
10-Feb	633285	05	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	DIT: 210682	58	AD Fin Clp	AD Fin Clp	49458
10-Feb	210601	04	COWSKULL ACCLIM POND	COWSKULL ACCLIM POND	PUYA		59	AD Fin Clp	AD Fin Clp	49459
16-Feb	185030	05	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	DIT: 185031, 185032	70	AD Fin Clp	AD Fin Clp	44886
16-Feb	632391	04	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW		70	AD Fin Clp	AD Fin Clp	44887
16-Feb	632964	04	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		71	AD Fin Clp	AD Fin Clp	44888
16-Feb	210601	04	COWSKULL ACCLIM POND	COWSKULL ACCLIM POND	PUYA		66	AD Fin Clp	AD Fin Clp	44889
16-Feb	632789	04	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW	DIT: 632788	67	AD Fin Clp	AD Fin Clp	44890
16-Feb	632889	04	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW	DIT: 632888	73	AD Fin Clp	AD Fin Clp	54915
17-Feb	210588	04	WHITEHORSE SPRINGS	WHITEHORSE POND	COOP		68	AD Fin Clp	AD Fin Clp	44891
17-Feb	632786	04	CHAMBERS CR 12.0007	CHAMBERS CR + GARRISON	WDFW		59	AD Fin Clp	AD Fin Clp	49016
22-Feb	185238	05	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	DIT: 185030, 185031	60	AD Fin Clp	AD Fin Clp	49462
24-Feb	210592	04	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ	DIT: 632790	70	AD Fin Clp	AD Fin Clp	49463
16-Jan	632964	04	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		68	AD Fin Clp	AD Fin Clp	49455
24-Jan	632967	04	BIG SOOS CR 09.0072	SOOS CREEK HATCHERY	WDFW	DIT: 632897	56	AD Fin Clp	AD Fin Clp	54810
26-Jan	632877	04	GREEN R 09.0001	ICY CR HATCHERY	WDFW		69	AD Fin Clp	AD Fin Clp	49456
27-Jan	210684	05	WHITEHORSE SPRINGS	WHITEHORSE POND	COOP		55	AD Fin Clp	AD Fin Clp	49457
02-Mar	632889	04	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW	DIT: 632888	75	AD Fin Clp	AD Fin Clp	54683
08-Mar	632880	04	GORST CR 15.0216	GORST CR REARING PND	SUQ		65	AD Fin Clp	AD Fin Clp	54601
15-Mar	632783	04	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ	DIT: 210589	64	AD Fin Clp	AD Fin Clp	54603